

Opinion

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Why satellites matter

*The relevance of commercial satellites in
the 21st century – a perspective 2012-2020*



Summary of report

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Did you know that...?

- ... Billions of people around the world rely on satellite infrastructure every day to communicate, travel and get informed and entertained
- ... Since the eighties, the €300 billion global TV industry relies mostly on satellites to gather and distribute regular programming as well as live coverage of political, social and sports events like the London Olympics
- ... 80 million European households get information and entertainment directly via satellite TV, and an additional 66 million households' cable is fed by satellite—as satellite is highly cost and spectrum efficient for broadcasting data and media to a large audience
- ... Satellites provide global connectivity, enabling communication on a worldwide scale of essential information about critical human, social, political and economic events such as the Euro crisis and the Arab Spring
- ... Satellite networks underpin many voice, data and mobile networks, providing them with a means to carry traffic overseas when other alternatives like undersea cables are absent
- ... Internet connections on planes, cruise ships and oil platforms are all provided via satellites
- ... Precision agriculture, tracking of fishery policies and weather and climate-change predictions all rely on satellites
- ... Thousands of companies and governments around the world use satellites as a “safety net” and for critical communications and data distribution
- ... Daily operations of most communications and energy networks, including data centers providing services for financial markets, rely on precise timing information received by satellite
- ... Satellites provide critical communications capabilities in support of rescue and relief efforts during emergency and disaster situations such as the 2010 earthquake in Haiti, the tsunami in 2004 and hurricane Katrina in 2005
- ... Satellites offer Internet connectivity to all citizens in rural and remote areas in Europe and around the world within a matter of days
- ... Satellites provide fast broadband, which in combination with terrestrial infrastructure, is a fast and cost-effective way to deliver the EU's Digital Agenda 2020 goals
- ... The use of satellites as a highly efficient technology for distribution of large amounts of data helps to ease discussions about lower network quality of service or high-bandwidth service limitations depending on tariff chosen
- ... Peacekeeping missions, troops abroad and border security around the world rely on secure communications provided by satellites
- ... The satellite industry is strategically important for Europe, supplying thousands of high-tech jobs, accounting for more than half of all commercial communications satellites in space with a value of over €20 billion, enabling independent launch and defense capabilities and putting Europe at the leading edge of new state-of-the-art technologies

A vision of 2020...

- ... Everyone in Europe will have access to broadband services and a next-generation service experience
- ... Most Europeans will experience HD and ultra-HD media and TV viewing at home on multiple sets as linear viewing continues to be the mode of choice for consuming TV content
- ... Media content will be delivered using a combination of fiber, cable networks, wireless terrestrial networks and satellites, leveraging the strengths of each individual technology and forming “hybrid satellite-terrestrial” networks
- ... Future terrestrial and mobile networks will rely on satellites for cost-efficient multicast of high-bandwidth data streams and high-definition media, delivering a next-generation converged service experience to consumers in the most effective way—in an environment where it is predicted that video may represent more than 85% of consumer IP traffic
- ... Satellite technology will be a key solution for wide-scale media and data distribution, whether for digital cinemas, private homes or enterprises in urban or remote locations
- ... Satellite services will remain a non-intrusive, instant infrastructure, neither harming protected areas nor disturbing delicate ecosystems
- ... Terrestrial networks will rely on satellite and fiber for efficiency, e.g., to distribute high-demand content to the network edges speedily
- ... Remote facilities, energy plants and industrial processes will be monitored 24/7 by satellite
- ... Maritime and aeronautical users will have access to fast data and voice communications around the globe via innovative satellite systems, allowing ultimate advanced traffic monitoring and management
- ... Europe will lead the global effort to establish internationally accepted modeling and forecasts for climate change using satellite information

... and how it could be achieved

- ... Policies should recognize, enable and make use of multiple technologies in the context of developing cost-effective next-generation networks that respond to real user needs based on market expectations
- ... The satellite should be understood and supported as a long-term enabler as it helps relieve data volume, allowing users to enjoy the best speed experience possible, as well as being a key enabler of immediate connectivity anywhere
- ... The global nature and specific architecture of satellite services should be taken into consideration when evaluating spectrum allocations and determining sustainable spectrum usage

Why satellites matter

In the last fifty years, satellites played a key role in the growth of global communications, media and technology industries. During these years satellite communications grew to a €100 billion¹ industry, enabling breakthroughs like intercontinental telephony, live television from remote regions, the broadcasting of television channels to all citizens, global positioning, trunking for telecom operators and reliable data networks for private companies. In recent years, satellite technology has seen a significant leap in advancement. Multi-spot beams allow for much higher throughput and lower costs, and are using frequencies even more efficiently.

In today's European society, free and open communication is anytime, anywhere and accessible by everyone. The public values the availability of a multitude of open communication channels, catering to and fulfilling the different needs of citizens. And the ubiquitous nature of satellites—out of view from earth, high in outer space, but in view of wide regions of the globe, make them unique beacons for robust communications and instruments of democracy and freedom in Europe and around the globe.

Europe has recognized the relevance of communications early, and the EU aims to accelerate the ongoing digitization within and across European countries. But the magnitude of the debt crisis and its effect on employment is forcing EU governments to rethink their approach to stimulating growth and set new horizons. The ongoing crisis is a wake-up call to the EU. It is now determined to capitalize on its strengths and establish ambitious objectives to ensure a sustainable future. The Agenda 2020, and in particular its ambitious Digital Agenda component, equips the EU with a roadmap and a series of initiatives to deliver smart, sus-

tainable and inclusive growth. This is an opportunity but also an imperative for the EU to leverage its successful technology capabilities. Among these, satellite systems and services, whose economic benefits are often overlooked, have the potential to contribute greatly towards these objectives.

In this context, satellites have a key role to play in bringing digital content, delivering very high quality video and enabling efficient broadband networks.

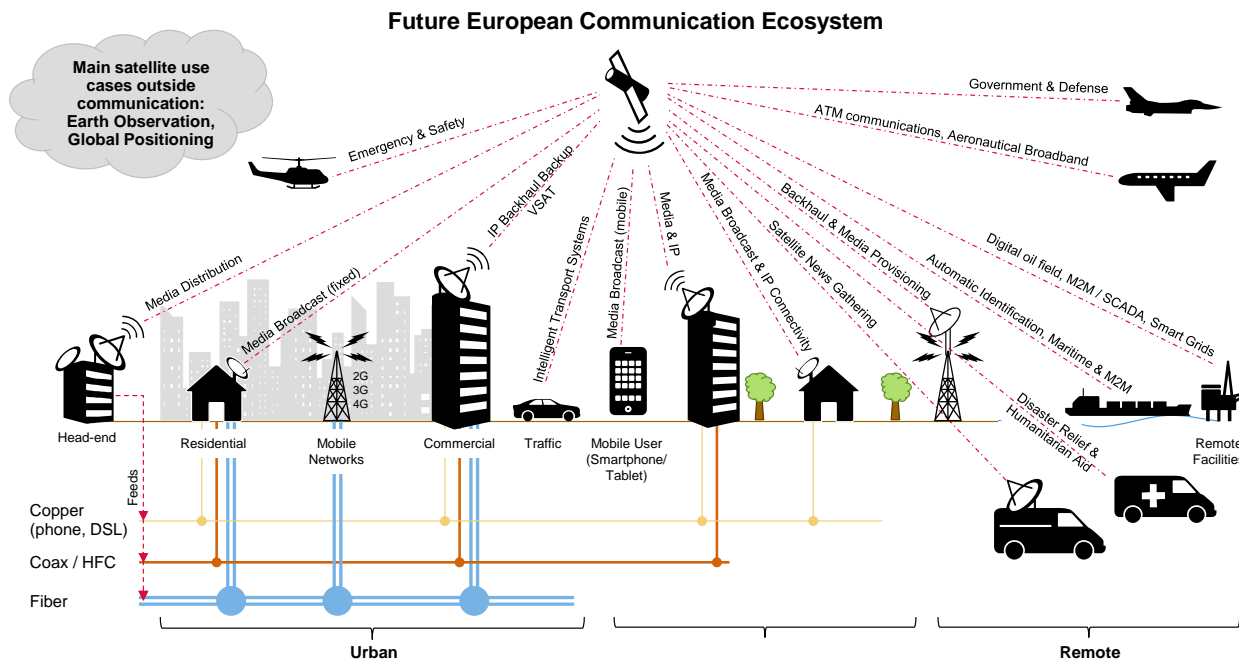
Satellites will—and must—be an integral part of the future communications ecosystem

In the foreseeable future, communications will be based on a multitude of technologies. Existing infrastructure based on copper cables will continue to play a major role for the provisioning of telephony line as well as DSL. With the further roll-out of fast and ultra-fast broadband based on new DSL standards, fiber will be rolled out to local concentration points. Cable networks will continue to provide ultra-fast broadband and broadcast services in densely populated areas. In parallel, the first fiber-to-the-home connections have become available and will be rolled out further in bigger cities and selected suburban and densely populated rural areas.

On top of that, mobile networks will continue to offer 3G/HSPA services, allowing mobile Internet access. With the emergence of LTE, fast mobile broadband will become available in cities and use of the digital dividend will allow basic mobile broadband in more rural areas. Digital terrestrial TV will continue to broadcast channels to households.

This mostly terrestrial-driven vision might sound appealing, but based on our analysis of technologies, use cases and economics, we are convinced that, beyond all of these networks and applications, an efficient communications

¹ In this report, billion refers to 1,000 million



ecosystem will require satellites to cope with the immense volume of data that will have to be distributed throughout these networks, to ensure fast roll-out, superior economics and robust network operations. According to Cisco, the sum of all forms of video will be approximately 86% of the consumer IP traffic by 2016. Terrestrial networks will not be able to cope with those volumes alone: satellite will have to be used for offloading traffic.

Some examples to illustrate the need:

- In coming years, the resolution of TV channels will increase and provide a superior user experience. Linear TV will continue to be the mode of choice for most consumers, with online viewing increasing to coexist alongside but not replace linear viewing. These linear HD and Ultra-HD TV channels will require significant bandwidth, which can only be provided by DTH satellite, costly fiber and potentially cable. But only the satellite's intrinsic point-to-multipoint broadcast capabilities allow cost- and spectrum-efficient content distribution across larger geographic regions.
- Mobile video consumption is the major capacity driver in today's mobile networks.

Providing media content everywhere would require an expensive fiber roll-out to feed mobile base stations everywhere. Satellites offer alternative, cost-efficient solutions by feeding these high-demand data streams directly to the mobile towers in *mobile-satellite hybrid networks*.

- Rolling out fiber to the home or to enterprises in rural and remote areas is often expensive and time consuming. New innovative satellites offer a solution to provide broadband access directly to the end users at home, or as a backhauling component for terrestrial technologies (e.g., providing media content to the local DSLAM for DSL customers).

In addition to being part of the terrestrial communications system, satellites can provide services where other technologies struggle or fail, such as decongesting airwaves for air-traffic management in complex and dense airspace, or providing broadband access to aerial or maritime users. We therefore envision a future communications ecosystem leveraging all terrestrial wired and wireless and satellite technologies based on their respective key capabilities.

Satellites provide unique and differentiating key capabilities for communications systems

Satellite communications offer differentiating capabilities, which enable specific use cases and illustrate the role satellites will play in the overall communications ecosystem.

Satellite communications allow for high data rates and highly efficient broadcasting

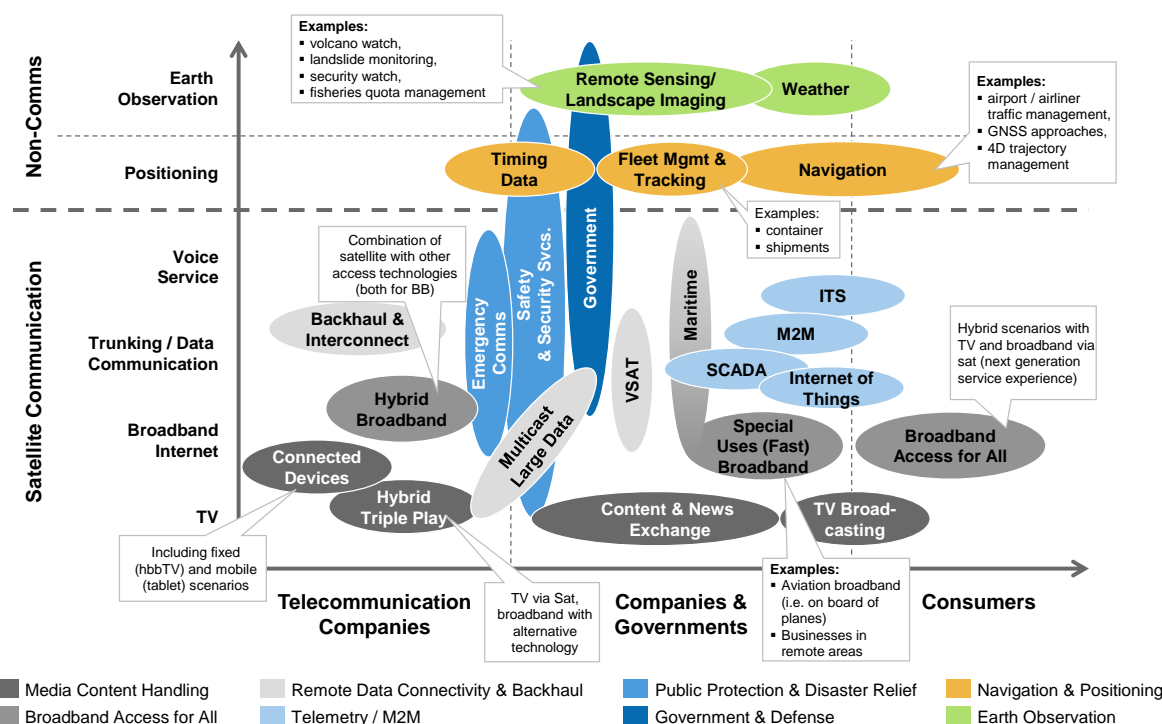
- **Broadcast efficiency:** given the large coverage and limited need for terrestrial infrastructure, satellites offer unique broadcasting capabilities. They are **highly cost efficient for broadcasting**, allowing distribution of data and media to a broad audience with limited cost and requirements for spectrum when compared with any other technology.
- **High bandwidth with efficient spectrum usage:** new technologies (multi-spot beams in the C, K_u and K_a bands) make it possible to provide tailored content two-way to small areas. This further increases spectrum efficiency and reduces cost for applications

targeting small areas, enabling very high data rates/bandwidth services irrespective of landmass or maritime location, e.g., for **fast broadband**.

Satellite communications do not require complex ground infrastructure while being interoperable with terrestrial services and running on solar power during their entire lifetime

- Limited technical requirements: satellites require only **small and simple ground equipment** to enable communications services. This simplicity not only allows for **machine-to-machine** use cases but also allows satellite communications to act as an **enabler of democracy** in times of crisis, since satellites remain resilient to terrestrial infrastructure tampering or destruction and can maintain communication links, e.g., as seen by the broad availability of reports from the Arab Spring, using satellite equipment for transmission.
- Interoperability with terrestrial services: satellite communications can be **combined with terrestrial communications technologies**, making it possible to provide services

Satellite Use Cases



in **hybrid scenarios**, e.g., to provide triple play (telephony, broadband Internet and TV) everywhere, where satellite technology provides part of the service and terrestrial technology the rest, **increasing the overall efficiency of the solution by off-loading terrestrial networks**. Another example for a hybrid system could be a VSAT installed in a village library/school to be extended via terrestrial wireless to the surrounding homes.

- Simple redeployment of earth equipment: given the simple and standardized ground equipment, a redeployment of customer equipment is very easy. For example, in case a fiber roll-out reaches an area, ground equipment can be repurposed in a different service area with limited costs/efforts. This is an especially interesting feature that helps accelerate **broadband for all**, noting however that already today satellites offer consumer broadband download speeds of 18 Mbit/s.
- **Satellites run on solar power**: these complex yet far-reaching pieces of infrastructure make use of solar power to offer uninterrupted services to users for fifteen to twenty years. In addition, reception of satellite services does not imply disruption of protected landscapes through civil works and creates very limited electro-magnetic emissions.

In the overall communications ecosystem, satellites can ensure transparent and uncensored communications and drive net and technology neutrality

- Transparent and neutral communication: due to its independence from terrestrial services, broad coverage profile and resilience against political disturbance, satellite technology provides reliable, technologically neutral service. Satellite communications therefore support **unrestricted and uncensored communication, e.g., from and with-**

in conflict zones, and contribute to spreading democracy.

- As the **satellite has clear advantages when it comes to dissemination of high-bandwidth services**, e.g., by **offloading traffic in hybrid solutions**, its use for such services significantly **lowers the overall cost of network deployment** and as such weakens the argument that high-bandwidth services should be left to individual commercial agreements (e.g., regarding quality of service or services carried depending on tariff) between service providers and network operators.
- **Ensuring technology redundancy and reducing risk within the communications mix**: today, the majority of new communications services rely solely on fiber as the primary method for backhauling of cable, DSL and mobile networks. Satellites provide a redundant and robust alternative to fiber for a multitude of use cases, making the end-customer service technology neutral, more economical and thus more competitive, and mitigating the risk of a single point of failure of communications. An example of the importance of alternative technologies was the 2005 undersea cable disruption in Pakistan, where Internet access and international phone calls were provided via satellite during the eleven days of service interruption.

Satellite communications offer global coverage with instant and interoperable services

- Distance-agnostic global and cross-border coverage: a single **satellite can cover a significant area** and a small fleet (e.g., three geostationary satellites) can achieve global coverage with communications services. **Maritime and aerial services** benefit especially from this large coverage, **allowing for anytime/anywhere communications**; in addition, satellites can **augment terrestrial services in rural and remote** areas. Such coverage also enables global propositions,

where European companies and experts support other regions, e.g., with tele-education or tele-medicine/health. Many global corporations and governmental agencies run their global network via satellite in order to have one robust provider and not a number of providers for various countries.

- Speed and versatility of deployment/instant infrastructure: once designed, manufactured and launched, a satellite stays an always-on infrastructure for the rest of its lifetime. This **allows a very fast roll-out of the service on the ground** (irrespective of distance from the nearest central office of a communications company), e.g., in case **backhaul** for a mobile network is needed, a company needs **IP connectivity (VSAT)** or to roll-out **ITS** (Intelligent Transport Systems) services broadly.
- **Interoperability with other satellite services:** satellite communications can be combined very easily with other satellite services like remote sensing/earth observation and global positioning. Combined with global coverage, this enables integrated applications, such as advanced **fleet and traffic management and monitoring** applications.

Orbital services are resilient and reliable with predictable quality independent of terrain or distance

- Independence and resilience to earth events: **satellites are not influenced by events on earth**, such as natural or man-made disasters and social or political events. This makes satellite communications **key for emergency services** but also as **backup to terrestrial infrastructure**. Furthermore, providing service by satellite is independent of the local terrestrial environment, i.e., there is no need for civil works and the service can be supplied in difficult environments (e.g., mountain areas) and therefore has a speed advantage when it comes to rapid deployment of critical communications services.
- Reliability and security of communications: satellites are carefully engineered to allow operation for fifteen to twenty years in a very harsh orbital environment, out of reach for maintenance. This high-quality infrastructure has very limited planned downtimes and rarely suffers service disruptions. In addition, **satellite communications offer a predictable and stable quality of service, independent of distance** (unlike terrestrial wireless or copper-based technologies, where distance is a limiting factor for speed and quality). This reliability is why **security and military services**, as well as **news-gathering services**, all rely on satellite communications.

Satellite services significantly contribute to European policies and their implementation

The Agenda 2020, and the Digital Agenda, is a chance for satellite industry to contribute further to Europe’s development and competitiveness, and assert its leadership. Satellites constitute key communication channels to support the growth of high-definition video and high data-rate applications expected by everyone in an increasingly demanding converged digital environment.

Many EU policies already rely on satellites for implementation—e.g., digital divide, global environment monitoring—or for the monitoring of conformance to EU rules and regulations. Satellite systems enable commercial and institutional services that continue to grow in strategic importance for Europe. Already many European policies depend on satellite technologies to provide cost-efficient and effective monitoring of resources (e.g., fish stocks, fair access to natural resources), monitoring of policy implementation (e.g., border control) and Common Agricultural Policy (CAP).

With the now well-established link between a knowledge-based economy and the diffusion and use of information through network ac-

cess, policy instruments are being designed at EU and national levels to promote access to next-generation networks. These networks are to benefit from a technology mix in which satellites contribute to the resilience of the overall infrastructure. The EU's goal is for 500 million EU residents to have a connection speed of 30 Mbps by 2020. With quick deployment times, satellite terminals can already provide more than the average ADSL speed anywhere within Europe, thanks to high-throughput satellites that represent a quantum leap, and this is likely to increase beyond fast broadband as technology further improves by the end of the decade. In addition, advanced modem and satellite technologies will further improve spectrum efficiency by several orders of magnitude. There has been tremendous improvement in satellite capacity over the last three to five years—the three most advanced satellites launched recently for broadband services together have more capacity than all satellites available in 2010 combined. These broadband services are delivered in addition to satellites’ essential role of off-loading video content from terrestrial networks in order to free them up for more revenue-generating applications.

The increasing complexity and interdepend-

Contribution of Satellite Solutions to European Policy
Satcom, Earth Observation and Satellite Navigation & Positioning

Satellite Solutions EU Policy Area	Media content distribution	Remote data connectivity & backhaul	Broadband	Telemetry & M2M	Government Services	Aero / Maritime	Earth Observation & Meteo	Navigation & Positioning
Digital Divide and Broadband for all	Key enabler	Integral part Fast deploy.	Integral part Fast deploy.			Key enabler		
Digital Literacy	Key enabler	Integral part	Key enabler					
Health care			Integral part					
Emergency / eCall		Gap filler	Integral part Fast deploy.		Key enabler Fast deploy.	Key enabler	Key enabler	Key enabler
Security				Key enabler	Key enabler	Key enabler	Key enabler	Key enabler
Risk management					Key enabler	Key enabler	Key enabler	Key enabler
Climate change		Integral Part Fast deploy.		Gap filler			Key enabler	
Energy / Smart Grid		Integral part Fast deploy.	Integral part Fast deploy.	Integral part			Integral part	Integral Part
Land management			Integral part	Gap filler	Integral Part		Key enabler	Key enabler
Agriculture policy			Key enabler	Gap filler			Key enabler	Key enabler
Transport & mobility			Integral part Fast deploy.	Integral part		Key enabler	Key enabler	Key enabler

ence of information technology, telecommunications, transportation, energy and health-care systems make them extremely vulnerable in case of man-made or natural disasters; satellites bring unique complementary strengths to these infrastructures and lower the risks.

As needs for mobility and connectivity grow further, the satellite is well suited to support a growing range of applications fulfilling EU policies' needs (e.g., maritime safety, Single European Sky and traffic challenges) and enabling agenda goals (e.g., reducing congestion in urban centers by enabling broadband in less urban areas for teleworking).

Satellite services enable governments around the world to reach their policy goals. In addition to providing broadband for everyone, satellite services also support tele-education and telemedicine, disaster preparedness, mobile banking applications, e-government services and many more applications.

Several prerequisites are required to implement a future communications ecosystem

Despite many hurdles, the satellite industry has successfully permeated many ICT sectors and developed into a multi-billion-euro industry, yet it remains highly vulnerable to regulations and policies. For European economies and citizens to reap the full benefits of satellites, several prerequisites have to be fulfilled and need to be considered in future policies and direction setting.

Secure orbital slots and spectrum for services

Satellite systems are dependent on two critical regulatory resources to operate: orbital slot and spectrum.

Satellite services are inherently global and as such, regulators should take the global component into consideration with regards to the allocation and usage of spectrum. Satellite operators have invested substantially in new satellites based on increasing demand. This investment would be stranded if the spectrum

for which these satellites have been designed could no longer be used, as once in orbit the spectrum specifications on a satellite cannot be altered. Furthermore, crucial services that were supposed to be provided on these frequencies might no longer be provided, once these frequencies are no longer available or holes appear in the satellite footprint because of European or other regional-only decisions on use of spectrum.

One example would be C-band services, which are in high demand in Africa but not as widely used in Europe. Due to the broad coverage zones, any regulation in Europe also affects North African service delivery.

The ITU plays a central role in allocating and managing the process of coordination of orbital slots and associated spectrum rights, as well as spectrum allocations in general and the recording procedures for space systems and Earth stations.

Securing spectrum is critical for the success of satellite applications, and allocated spectrum is a valuable asset in global competition. Without strong support from the EU and ESA, the European satellite industry could be at risk of losing some of its critical spectrum resources.

Policies need to enable hybrid solutions and not negatively impact their roll-out

Europe's Digital Agenda foresees a wide-scale broadband roll-out and adoption in order to enable economic growth driven by the next level of digitization. A challenge for policy-makers is to design policies that are technology neutral and cost optimal, since the next-generation service experience requires bandwidths that can be delivered by only few technologies today.

But this intended service experience is also possible with hybrid networks, which combine multiple technologies into one solution: for example, terrestrial-satellite or mobile-satellite hybrids. These would allow a cost-efficient service delivery, requiring less roll-out of cost-

ly fiber and leveraging the unique efficiency of satellite technology.

In order to enable these hybrid networks, policymaking needs to foresee the option of combining technologies on different levels, from the last mile to direct broadcast to mobiles to content distribution in backhaul networks.

One example would be broadband roll-out aid in rural areas. A next-generation service with a net ultra-fast bandwidth could be enabled by a hybrid system of 3G or LTE for Internet data access together with satellite broadcast for HDTV and large data-file distribution. This would require development of new home gateways but could still speed up the roll-out and improve the take-up rate of ultra-fast broadband.

Global market access is required to reap full benefits of global coverage

Satellite services are capable of connecting Europe to the rest of the world. While most countries allow market access for foreign satellite operators in an open and transparent manner the way Europe does, some countries have a more or less closed regime, favoring their national satellite industry or hindering foreign satellite industries. In order to reap the benefits of global satellite communications services, Europe should in trade negotiations ask for an open-skies regime, which would grant foreign operators the same or very similar rules and regulations as for local operators.

Summary

The commercial satellite services industry has been growing at a sustained pace for decades, and its relevance to economic growth as well as its role in ensuring Europe's position as a leading space power is well established. Satellite communications can support the further growth of Europe's and the global digital society with unique capabilities, enabling cost-efficient, fast service delivery. Satellites will continue to deliver efficient broadcast services on a global basis but will also serve a multi-

tude of unique use cases in innovative solutions and/or infrastructure mixes.

Broadcast and multicast services are most efficient with satellites, making them a key building block of hybrid networks

Satellites should be part of the future telecommunications ecosystem to continue efficient media delivery. For now, satellite communications will remain the most cost-efficient solution to provide a next-generation service experience in a hybrid setup with terrestrial networks.

Future terrestrial networks should leverage the efficient distribution of data and media via satellite to avoid network overload, reduce the need for roll-out of costly backhauling solutions as well as to reduce last-mile infrastructure requirements in rural areas.

Satellite communications can speed up broadband roll-out in Europe and allow access for all already today

Satellite broadband services are already available today for European citizens and in many developing economies. Incentivizing and promoting the use of satellite services can for a significant part of society make the difference between no network access and a viable connection and inclusion in the digital society.

With new technologies, fast broadband access via satellite is a viable option for consumers and businesses in remote and low-density-population areas, where alternative technologies are not available or too costly to roll out.

Satellites offer irreplaceable capabilities for emergency communications, navigation, remote sensing,...

The unrivaled options for emergency services, positioning and navigation, disaster recovery and Earth observation need to be recognized and protected.

Satellite communications are often the only viable technology for disaster-related services, where rapid deployment and reliable commu-

communications are critical and when other networks may be destroyed or overloaded.

Satellite-based imaging services support the development and implementation of future resource- and environment-management solutions. Already today, satellite-gathered data help to implement, monitor and manage policies such as fishery quotas, agricultural policies and forestry strategies.

Modern traffic navigation and management services for all modes of transport are dependent on satellite-provided position and timing data. Applications from 4D aerial trajectory management to precision agriculture and fleet management are only possible thanks to satellites.

Satellites' benefits need to be enabled by policies, including securing the key resources of orbit and spectrum

The satellite is an unobtrusive technology that is often overlooked, especially in policymaking. In order to allow a better integration in the communications ecosystem, satellites should be made more visible, especially the options and potential benefits of hybrid networks and solutions.

To reap the benefits of satellites, key resources need to be secured. Satellite communications are extremely dependent on a well-protected and managed spectrum on a global level, since signals from the orbits are susceptible to interference from terrestrial applications.

In light of the essential role that satellite systems play and will continue to play in enabling Europe 2020 objectives to be achieved, regulators and government organizations should support the satellite industry and operators in international negotiations for frequency allocations in order to secure uninterrupted service provisioning today and further roll-out tomorrow.

The satellite industry contributes significantly to the European economy and is a major exporter of services

With the four major satellite operators, the most important launch company and a significant share of satellite manufacturers, Europe is the major hub for the commercial satellite industry. Due to the global footprint and nature of the industry, satellites are a large contributor of exports to the rest of the world. This not only creates jobs and generates revenue in Europe but also allows the Europe to increase its political and economic strength.

The European satellite industry today directly and indirectly creates more than 200,000 highly qualified jobs and €10 billion of revenue. Future satellite services have the potential to contribute more than €100 billion of benefits to Europe, to help avoid billions of costs in the roll-out of networks and to increase the European GDP by accelerating broadband roll-out and closing the digital divide.

About this report

This report was developed by Booz & Company with funding from the European Satellite Operators' Association. It presents an independent, fact-based view on the future of commercial satellites with a focus on communications services in and for Europe.

For a detailed description of satellite technology and its use cases please also see the long version of this report.

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